



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

| APPLICATION NO.  | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO.             | CONFIRMATION NO.            |
|--|-------------|----------------------|---------------------------------|-----------------------------|
| 10/588,549   | 04/13/2007  | Masahide Matsuura    | 294551US0PCT                    | 8443                        |
| 22850  | 7590        | 10/27/2010           |                                 |                             |
| OBLON, SPIVAK, MCCLELLAND MAIER & NEUSTADT, L.L.P.<br>1940 DUKE STREET<br>ALEXANDRIA, VA 22314 |             |                      | EXAMINER<br>YANG, JAY           |                             |
|  |             |                      | ART UNIT<br>1786                | PAPER NUMBER                |
|  |             |                      | NOTIFICATION DATE<br>10/27/2010 | DELIVERY MODE<br>ELECTRONIC |

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

patentdocket@oblon.com  
oblonpat@oblon.com  
jgardner@oblon.com

|                              |                                      |  |  |
|------------------------------|--------------------------------------|--|--|
| <b>Office Action Summary</b> | <b>Application No.</b><br>10/588,549 | <b>Applicant(s)</b><br>MATSUURA ET AL. |  |
|                              | <b>Examiner</b><br>J. L. YANG        | <b>Art Unit</b><br>1786                |  |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

#### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) ☒ Responsive to communication(s) filed on 18 August 2010.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) ☐ Claim(s) 1-8 and 10-25 is/are pending in the application.  
4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-8 and 10-25 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 07 August 2006 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☒ All    b) ☐ Some \*    c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

- |   |   |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftperson's Patent Drawing Review (PTO-948)   | 5) <input type="checkbox"/> Notice of Informal Patent Application                       |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)<br>Paper No(s)/Mail Date <u>07/06/10</u> . | 6) <input type="checkbox"/> Other: _____  |

### **DETAILED ACTION**

1. This Office Action is in response to the Applicant's Amendment filed 08/18/10.

#### ***Response to Amendment***

1. The rejection of Claims 1-8, 10-19, 21, and 22 under 35 U.S.C. 103(a) as being unpatentable over Tsuboyama et al. (JP 2002-343572 A) in view of Tomita et al. (US 2006/0141284 A1) as evidenced by Thoms et al. (JP 2003-317966 A) is overcome by amendment.
2. The rejection of Claim 20 under 35 U.S.C. 103(a) as being unpatentable over Tsuboyama et al. (JP 2002-343572 A) in view of Tomita et al. (US 2006/0141284 A1) and Lamansky et al. (US 2002/0182441 A1) is overcome by amendment.
3. The rejection of Claim 23 under 35 U.S.C. 103(a) as being unpatentable over Tsuboyama et al. (JP 2002-343572 A) in view of Sakaguchi et al. (US 6,703,146 B1) is overcome by amendment.

#### ***Claim Rejections – 35 USC § 103***

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

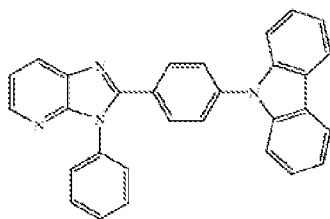
2. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

3. Claims 1-8 and 14-16, 18, 19, and 21-25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tsuboyama et al. (JP 2002-343572 A) in view of Mishima et al. (US 2002/0096995 A1) as evidenced by Nii (US 6,693,295 B2) and Tsuboyama et al. 2 (US 6,783,873 B2).

Regarding Claims 1-8, 15, 16, 18, 19, and 21-25, Tsuboyama et al. discloses an organic EL device comprising a cathode (11), an electron-transporting layer (16), a light-emitting layer (12a), a hole-transporting layer (13), an anode (14), and a substrate 915) in that order (Drawing 1). Tsuboyama et al. discloses the construction of flat panel displays that comprises such organic EL devices ([0069]). Tsuboyama et al. discloses the use of nitrogen-containing aromatics such as CBP (which has two carbazole groups) as host material for the light-emitting layer and Ir(ppy)<sub>3</sub>, a phosphorescent metal complex, as the light-emitting dopant at 6% ([0104], [0018]). Tsuboyama et al. discloses the use of aluminum quinolate as material for the electron-transporting layer ([0113]). However, Tsuboyama et al. does not explicitly disclose an electron-transporting material with a hole mobility greater than the limit as recited by the Applicant in Claim 1.

Mishima et al. discloses a wide range of nitrogen-containing aromatic compound for use as electron-transporting material in an organic EL device exemplified below:



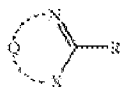
(page 6). Mishima et al. further discloses that such compounds have an ionization potential of 5.9 eV or more ([0022]). It would have been obvious to one of ordinary skill in the art at the time of the invention to substitute such compounds for aluminum quinolate in the electron-transporting layer in the organic EL device as disclosed by Tsuboyama et al. The motivation is provided by the fact that such compounds as disclosed by Mishima et al. are known material for effective electron-transporting for an organic EL device, rendering the substitution predictable with a reasonable expectation of success. The ionization potential of CBP = 6.1 eV as evidenced by Nii (col. 32, Table 1). This would result in a difference in  $I_p(\text{electron-transporting material}) - I_p(\text{host material}) = (5.9 \text{ eV or more}) - (6.1 \text{ eV}) = \geq -0.2 \text{ eV}$  which is within the range as claimed by the Applicant.

Furthermore, it is the position of the Examiner that one of ordinary skill in the art would be motivated to produce an electron-transporting material with a hole mobility  $> 10^{-5} \text{ cm}^2/(\text{V}\cdot\text{s})$  from the disclosure of Mishima et al. The motivation is clearly provided by the fact that having high hole mobilities would facilitate efficient hole-transfer to the cathode leading to improved device performance. Furthermore, it has been long established that “where the general conditions of a claim are disclosed in the prior art, it

Art Unit: 1786

is not invention to discover the optimum or workable ranges by routine experimentation”

*In re Aller*, 220 F.2d 454, 105 USPQ 233, 235 (CCPA 1955). MPEP 2144.05. Mishima et al. discloses a wide variety of nitrogen-containing aromatic compounds of the following form:



(page 5) that are highly similar to the nitrogen-containing aromatics as disclosed by the Applicant's Specification (pages 5-9 vs. pages 7-34). Thus, it would be reasonable to expect such same class of compounds to have similar hole mobilities that are in the range of  $10^{-7}$  cm<sup>2</sup>/(V·s) and can further be tuned through appropriate experimentation.

Regarding Claim 14, the triplet energy of Ir(ppy)<sub>3</sub> = 2.4 eV as disclosed by Tsuboyama et al. 2 (col. 7, lines 50-52). The triplet energy of the electron-transporting compounds as disclosed by Mishima et al. have minimum triplet energy levels of 60-90 kcal/mol (2.6-3.9 eV) ([0023]).

4. Claim 17 is rejected under 35 U.S.C. 103(a) as being unpatentable over Tsuboyama et al. (JP 2002-343572 A) in view of Mishima et al. (US 2002/0096995 A1) and Tyan et al. (US 2005/0073228 A1) as evidenced by Nii (US 6,693,295 B2) and Tsuboyama et al. 2 (US 6,783,873 B2).

Tsuboyama et al. in view of Mishima et al. discloses the organic EL device of Claim 1 as shown above using CBP as host material. However, they do not explicitly disclose a host material with a triplet energy 3.3-3.7 eV.

Tyan et al. discloses the possibility of using electron-transporting materials as host material with dopants = phosphorescent metal complexes ([0099]). It would thus have been obvious to one of ordinary skill in the art to substitute any of the electron-transporting materials as disclosed by Mishima et al. (that is different from the compound used as the material for the electron-transporting layer) for CBP as host material. The motivation is provided by the fact that the use of electron-transporting materials as host materials are known as disclosed by Tyan et al., in addition to the fact that the electron-transporting compounds as disclosed by belong to the same class of nitrogen-containing aromatic compounds as CBP along with meeting the energetic requirements of having a higher triplet energy than the iridium complex (for efficient energy transfer to the dopant) of 2.6-3.9 eV (Mishima et al., [0023]).

5. Claims 10-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tsuboyama et al. (JP 2002-343572 A) in view of Mishima et al. (US 2002/0096995 A1) and Begley et al. (US 2005/0208327 A1) as evidenced by Nii (US 6,693,295 B2) and Tsuboyama et al. 2 (US 6,783,873 B2).

Tsuboyama et al. in view of Mishima et al. discloses the organic EL device according to Claim 1 as shown above. However, they do not explicitly disclose a device comprising a plurality of electron-transporting layers.

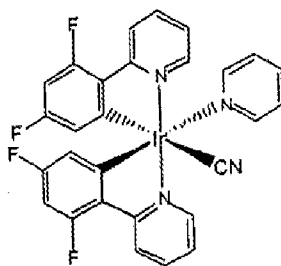
Begley et al. discloses an organic EL device and the possibility of having multiple adjacent electron-transporting layers (Fig. 1 vs. Fig. 4), both of which are located between the cathode and the EL material layer. It would thus have been obvious to one of ordinary skill in the art at the time of the invention to incorporate an additional layer comprising another electron-transporting derivative as disclosed by Mishima et al. The motivation is provided by the fact that such architecture is known as disclosed by Begley et al. that can promote enhanced electron transmittance. This would result in adjacent electron-transporting layers with similar (or identical if the same electron-transporting compounds is used)  $I_p$  values (such that  $\Delta I_p = \sim 0$ ) that can meet the optical energy and triplet energy gap limitations as claimed by the Applicant after a reasonable amount of experimentation (involving the compositions of just two layers).

6. Claim 20 is rejected under 35 U.S.C. 103(a) as being anticipated by Tsuboyama et al. (JP 2002-343572 A) in view of Mishima et al. (US 2002/0096995 A1) and Lamansky et al. (US 2002/0182441 A1) as evidenced by Nii (US 6,693,295 B22) and Tsuboyama et al. 2 (US 6,783,873 B2).

Tsuboyama et al. in view of Mishima et al. discloses the organic EL device according to Claim 1 as shown above. However, they do not disclose a phosphorescent complex with CN as ligand.

Lamansky et al. discloses the following light-emitting dopant:





(Fig. 7e, sheet 17). It would have been obvious to one of ordinary skill in the art at the time of the invention to substitute the above complex for Ir(ppy)<sub>3</sub> in the light-emitting layer of the organic EL device as disclosed by Tsuboyama et al. in view of Mishima et al. The motivation is provided by the fact that the dopant as disclosed by Lamansky et al. too is a phosphorescent iridium complex with a particular spectral profile in addition to the fact that Tsuboyama et al. allows for a wide variety of phosphorescent dopants such that the substitution would have been predictable with a reasonable expectation of success.

### ***Response to Arguments***

1. The Examiner acknowledges the fact that Tomita et al. does not qualify as prior art to the represent application under 35 U.S.C. 102(e) for the reason that the international application corresponding to Tomita et al. was published in Japanese.
2. The Applicant argues for the novelty of the importance of hole mobility of the electron-transporting layer. It is the position of the Examiner that in combination with the disclosure of Mishima et al. that provides nitrogen-containing aromatic compounds that are highly similar to the range of nitrogen-containing aromatics as disclosed in the

Art Unit: 1786

present application with the fact that it would be highly desirable to improve hole mobilities for improved hole injection to the cathode, the invention as claimed in Claim 1 would have been obvious to one of ordinary skill in the art.

### ***Conclusion***

**THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to J. L. YANG whose telephone number is (571)270-1137. The examiner can normally be reached on Monday to Thursday from 8:30 am to 6:00 pm Eastern.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, D. Lawrence Tarazano can be reached on (571)272-1515. The fax phone

Art Unit: 1786

number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/D. Lawrence Tarazano/  
Supervisory Patent Examiner, Art Unit 1786

/J. Y./  
Examiner, Art Unit 1786